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(54) SPINDLE MOTOR AND DISK DRIVE UNIT EQUIPPED THEREWITH

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a spindle motor reducible in size, thickness and cost, stably usable even under a variety of environments, and operable with low power consumption.
SOLUTION: A thrust bearing is constituted between the flat surface of the large-diameter part of a shaft of the spindle motor and the bottom face of a rotor, and a radial bearing having a dynamic pressure generation groove that is formed so as to make air flow toward the thrust bearing in the axial direction is constituted between the external peripheral surface of the large-diameter part of the shaft and the internal peripheral surface of the rotor. The rotor is magnetically applied with back-pressure in the direction opposing a floating force generated at the thrust bearing.

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CLAIMS

[Claim(s)]
[Claim 1]
Rota of the shape of an abbreviation cup which central opening is prepared in a revolving-shaft core, and specifies a cavity inside, Between the small outer-diameter section extended through central opening of this Rota, the inner skin of this Rota, the large outer-diameter section which counters radial, this small outer-diameter section, and the large outer-diameter section In the spindle motor equipped with the shaft which has a base from the central opening edge of this Rota to [is located and] inner skin, and the flat surface which counters in the direction of an axis,
While the radial bearing section which has the dynamic pressure generating slot of the configuration which the thrust bearing section is constituted [configuration] and makes a gas flow in the direction of an axis toward this thrust bearing section between the large outer-diameter section of said shaft and the inner skin of said Rota between the flat surface of said shaft and the base of said Rota is constituted,
The spindle motor characterized by carrying out magnetic back pressure to the surfacing force generated in said thrust bearing section in the direction which counters in said Rota.
[Claim 2]
The spindle motor according to claim 1 characterized by giving the surfacing force to said Rota by the annular projected part which projects in the direction of an axis being prepared in said central opening edge in the base of said Rota, or the radial inner circumference edge in the flat surface of said shaft, checking a flow of the gas into which this annular projected part flowed from said radial bearing section side, and raising the atmospheric pressure of said thrust bearing circles.
[Claim 3]
The spindle motor according to claim 1 characterized by establishing the dynamic pressure generating slot of the configuration which makes said gas flow toward the method side of the inside of radial, and the method side of outside in said thrust bearing section, and the surfacing force being given to said Rota by flow of the gas by this dynamic pressure generating slot.
[Claim 4]
Abbreviation cup-like Rota where central opening was prepared in the revolving-shaft core, The shaft which has a base from the central opening edge of this Rota to [is located between the small outer-diameter section extended through central opening of this Rota, the inner skin of this Rota, the large outer-diameter section which counters radial, this small outer-diameter section, and the large outer-diameter section, and] inner skin, and the flat surface which counters in the direction of an axis, In the spindle motor equipped with the base member which this shaft fixes,
Said base member has the end face of said Rota, and the flat side which counters through a gap,
While the radial bearing section which has the dynamic pressure generating slot of the configuration which the thrust bearing section is constituted [configuration] and makes a gas flow in the direction of an axis toward this thrust bearing section between the large outer-diameter section of said shaft and the inner skin of said Rota between the flat side of said base member and the end face of said Rota is constituted,
The spindle motor characterized by carrying out magnetic back pressure to the surfacing force generated in said thrust bearing section in the direction which counters in said Rota.
[Claim 5]
The spindle motor according to claim 4 characterized by giving the surfacing force to said Rota by the annular projected part which projects in the direction of an axis being prepared in the periphery edge in the end face of said Rota or the periphery edge in the end face of this Rota in the flat side of said base member, and the part that counters, checking a flow of the gas into which this annular projected part flowed from said radial bearing section side, and raising the atmospheric pressure of said thrust bearing circles.
[Claim 6]

The spindle motor according to claim 4 characterized by establishing the dynamic pressure generating slot of the configuration which makes said gas flow toward the method side of the inside of radial, and the method side of outside in said thrust bearing section, and the surfacing force being given to said Rota by flow of the gas by this dynamic pressure generating slot.

[Claim 7]

The spindle motor according to claim 1 to 6 characterized by being equipped with the ring-like member which regulates migration of the direction of an axis of said Rota near the point of the small outer-diameter section of said shaft.

[Claim 8]

In the spindle motor equipped with the cylindrical sleeve of the letter of end lock out by which the shaft rotated in one with Rota of the shape of an abbreviation cup which specifies a cavity, and this Rota, and this shaft are inserted in the interior,

While the opening side edge side of said sleeve counters in the base and the direction of an axis of said Rota, the thrust bearing section which uses a gas as a working fluid consists of that the dynamic pressure generating slot of the configuration which makes a gas flow to the method side of the inside of radial is formed in the opening side edge side of said sleeve, or the base of said Rota,

While the peripheral face of said shaft and the inner skin of said sleeve counter radial, the radial bearing section which uses a gas as a working fluid is constituted,

The spindle motor characterized by carrying out magnetic back pressure in the direction which counters said Rota with the operation direction of the dynamic pressure generated in said thrust bearing section.

[Claim 9]

It is the spindle motor according to claim 8 which the dynamic pressure which the direction slot of an axis is established in said radial bearing section as a dynamic pressure generating slot , and is generated in said thrust bearing section between the lock out side edge side of said sleeve and the end face of said shaft , and the air chamber which has an equivalent pressure substantially are formed , and is characterized by the surfacing force be given by collaboration with said thrust bearing section and this air chamber , as for said Rota .

[Claim 10]

The dynamic pressure generating slot of the configuration which makes a gas flow in the direction of an axis as a dynamic pressure generating slot is established in said radial bearing section. Between the lock out side edge side of said sleeve, and the end face of said shaft It is the spindle motor according to claim 8 which the dynamic pressure generated in said thrust bearing section and the air chamber which has an equivalent pressure substantially are formed, and is characterized by the surfacing force being given by collaboration with said thrust bearing section and this air chamber, as for said Rota.

[Claim 11]

Said shaft is a spindle motor according to claim 8 to 10 characterized by consisting of shank material and a bell shape outer case member attached in the peripheral face of this shank material, and forming the free passage hole which connects the upper limit section of said radial bearing section, and the lower limit section between this shank material and this outer case member.

[Claim 12]

In the spindle motor equipped with the cylindrical sleeve of the letter of end lock out by which the shaft rotated in one with Rota of the shape of an abbreviation cup which specifies a cavity, and this Rota, and this shaft are inserted in the interior,

While the peripheral face of said shaft and the inner skin of said sleeve counter radial, the radial bearing section which uses a gas as a working fluid is constituted,

While the air chamber by which the gas the pressure up was carried out [the gas] by flow of the direction of an axis of the gas which the dynamic pressure generating slot of the configuration which makes a gas flow in the direction of an axis as a dynamic pressure generating slot is established in said radial bearing section, and is generated in said radial bearing section between the lock out side edge side of said sleeve and the end face of said shaft is held is formed and, as for said Rota, the surfacing force is given by this air chamber,

The spindle motor characterized by carrying out magnetic back pressure in the direction which counters with the surfacing force of said Rota generated in said air chamber in said Rota.

[Claim 13]

Said shaft is a spindle motor according to claim 12 characterized by consisting of shank material and a bell shape outer case member attached in the peripheral face of this shank material, and forming the free passage hole which connects the upper limit section of said radial bearing section, and the lower limit section between this shank material and this outer case member.

[Claim 14]

In the spindle motor equipped with the cylindrical sleeve of the letter of end lock out by which the shaft

rotated in one with Rota of the shape of an abbreviation cup which specifies a cavity, and this Rota, and this shaft are inserted in the interior,
While the lock out side edge side of said sleeve and the end face of said shaft counter in the direction of an axis, the thrust bearing section in which the dynamic pressure generating slot of the configuration which makes a gas flow toward the method side of the inside of radial was established is constituted,
While the peripheral face of said shaft and the inner skin of said sleeve counter radial, the radial bearing section in which the dynamic pressure generating slot of the configuration which makes a gas flow in said direction of the thrust-bearing section was established is constituted,
The spindle motor characterized by carrying out magnetic back pressure in the direction which counters said Rota with the operation direction of the dynamic pressure generated in said thrust bearing section.
[Claim 15]
In the disk driving gear with which the rotation drive of the record disk which can record information is carried out, it is the disk driving gear which has housing, the spindle motor which is fixed to the interior of this housing and made to rotate this record disk, and an information access means for writing in or reading information to this record disk,
The disk driving gear characterized by coming to have the spindle motor indicated to claim 1 thru/or either of 14 as said spindle motor.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the disk driving gear equipped with the spindle motor and this spindle motor for the disk drive [minor diameter in a thin shape] which carries out the rotation drive of the record disk whose outer diameter is 1 inch.
[0002]
[Description of the Prior Art]
In order to support a shaft and a sleeve as bearing of the spindle motor used from the former in the disk driving gear which drives record disks, such as a hard disk, enabling free relative rotation, the hydrodynamic bearing using the fluid pressure of lubrication fluids, such as oil made to intervene among both, is proposed variously.
[0003]
If the configuration of the spindle motor equipped with such a conventional hydrodynamic bearing is explained, the shaft is supported free [rotation] through the radial liquid bearing of a vertical pair at the core of a sleeve, it is fixed to the base in one and the sleeve constitutes the holddown member. Moreover, the hub in which a magnetic disk is carried is attached in the upper limit of the shaft which penetrated the core of the sleeve and was projected up, and in the outer-diameter side of the lower limit of a shaft, while escaping and having a stop function, the thrust plate which constitutes a thrust liquid bearing has fixed pivotable. This thrust plate is contained in the hollow of the shape of a stage prepared in the lower part of a sleeve.
[0004]
The radial abutment which constitutes a radial liquid bearing is formed in the peripheral face of a shaft, the radial bearing side which counters this is formed in the bore side of a sleeve, and the slot for dynamic pressure generating is formed at least in one side of the radial abutment of these shafts and a sleeve.
[0005]
Moreover, the thrust abutment which constitutes said thrust liquid bearing is formed in vertical both the flat surfaces of a thrust plate, the thrust bearing surface which counters this is formed in the inside of the hollow of the lower part of a sleeve, and the top face of thrust covering, and the slot for dynamic pressure generating is formed in either [at least] these thrust plates, a sleeve or the thrust bearing surface of thrust covering. (For example, patent reference 1 reference) .
[0006]
However, application to small devices, such as a Personal Digital Assistant, is started, and, as for the disk driving gear with which such [in recent years] a spindle motor is used, the demand of the further thin-shape-izing is increasing.
[0007]
For this reason, he proposed the spindle motor for disk driving gears which made it possible to enlarge spacing between the radial bearing sections as much as possible, and to acquire desired bearing rigidity, the applicant of this application having made unnecessary the thrust plate for constituting the thrust bearing section, and enabling small and thin shape-ization of a motor (patent reference 2 reference).
[0008]
While more specifically constituting the thrust-bearing section between the upper limit sides of a sleeve and the inferior surfaces of tongue of a rotor hub in which a shaft is inserted and constituting the radial bearing section of a pair from a peripheral face of a shaft, and inner skin of a sleeve By holding oil continuously between the radial bearing sections of the side which adjoins the thrust-bearing section and this, and collaboration of both [these] bearings giving the desired surfacing force to Rota, and carrying out magnetic attraction of Rota to a base member side It is made to balance with the surfacing force of Rota generated in the thrust-bearing section and one radial bearing section.

[0009]
Moreover, the oil held at the radial bearing section of a pair While dissociating in the direction of an axis, forming the gas-liquid interface of oil and air, respectively and being held with the air held at the air interstitial segment formed between the shaft and the sleeve The oil held at the thrust bearing section forms the gas-liquid interface of oil and air in the taper seal department formed in the method side of the outside of radial of the thrust bearing section, and is held. That is, the oil held in a hydrodynamic bearing serves as a configuration divided and held with air at the oil held between the radial bearing sections of the side which adjoins the thrust-bearing section and this, and the oil held in the radial bearing section of another side, respectively.
[0010]
[Patent reference 1]
JP,2000-197306,A (the two - 4th page, the 1-3rd Fig.)
[Patent reference 2]
JP,2000-113582,A (the five - 6th page, Fig. 2)
[0011]
[Problem(s) to be Solved by the Invention]
However, from it being necessary to maintain the engine performance stabilized also under various environments, and such most small devices driving with a battery charger these days from diversification of the equipment with which these disk driving gear is used, in order to be more equal to use of long duration, the further low-power-ization has come to be required.
[0012]
On the other hand, since a property tends to change with fluctuation of external environments [oil], such as temperature and an atmospheric pressure, in the case of the hydrodynamic bearing which uses oil as a working fluid, the applicability will be restrained naturally.
[0013]
Moreover, in the hydrodynamic bearing which uses oil as a working fluid, at the time of bass with the high viscosity of oil, loss by the viscous drag becomes large, and the consumed electric power of a spindle motor increases.
[0014]
Even if it is under various environments, it is offering the spindle motor which it is stabilized, and can use and can be driven with a low power, while small, a thin shape, and low-cost-izing are possible for the purpose of this invention.
[0015]
Moreover, another purpose of this invention is being able to use it for a long time, and offering a reliable disk driving gear by having the above-mentioned spindle motor, while application to small devices, such as a Personal Digital Assistant's, is possible.
[0016]
[Means for Solving the Problem]
In order to solve the above-mentioned technical problem, invention according to claim 1 Rota of the shape of an abbreviation cup which central opening is prepared in a revolving-shaft core, and specifies a cavity inside, Between the small outer-diameter section extended through central opening of this Rota, the inner skin of this Rota, the large outer-diameter section which counters radial, this small outer-diameter section, and the large outer-diameter section In the spindle motor equipped with the shaft which has a base from the central opening edge of this Rota to [is located and] inner skin, and the flat surface which counters in the direction of an axis Between the flat surface of said shaft, and the base of said Rota The thrust bearing section is constituted. Between the large outer-diameter section of said shaft, and the inner skin of said Rota While the radial bearing section which has the dynamic pressure generating slot of the configuration which makes a gas flow in the direction of an axis toward this thrust-bearing section is constituted, it is characterized by carrying out magnetic back pressure to the surfacing force generated in said thrust-bearing section in the direction which counters in said Rota.
[0017]
In the above-mentioned configuration, gases, such as air, can make small loss at the time of the rotation which originates in a viscous drag also in the use under a low-temperature environment since property change, such as viscosity by the temperature change, is small compared with liquids, such as oil, and low electrification is attained. Moreover, also in the use under hot environments, since the fall of support rigidity resulting from a viscous fall is also controlled, it becomes possible to stabilize and use it under various environments.
[0018]
moreover, since viscosity of a gas is small compared with a liquid, and it is required to boil the dimension of

bearing comparatively and to secure it greatly compared with the bearing which uses oil when it is going to acquire predetermined support rigidity from it being compressible fluid Although the application to the bearing of small and a thin spindle motor is generally difficult By changing to bearing, carrying out magnetic back pressure of Rota, and supporting it like the above-mentioned configuration By making into max area in which each bearing occupies the formation part of bearing also in the dimension restricted by considering as min, an outer diameter becomes applicable also in the minimum spindle motor which drives the minor diameter disk which is 1 inch.

[0019]

Invention according to claim 2 is characterized by giving the surfacing force to said Rota by the annular projected part which projects in the direction of an axis being prepared in said central opening edge in the base of said Rota, or the radial inner circumference edge in the flat surface of said shaft, checking a flow of the gas into which this annular projected part flowed from said radial bearing section side, and raising the atmospheric pressure of said thrust bearing circles in the spindle motor of claim 1.

[0020]

In the spindle motor of claim 1, the dynamic pressure generating slot of the configuration which makes said gas flow toward the method side of the inside of radial and the method side of outside is established in said thrust bearing section, and invention according to claim 3 is characterized by the surfacing force being given to said Rota by flow of the gas by this dynamic pressure generating slot.

[0021]

Abbreviation cup-like Rota where, as for invention according to claim 4, central opening was prepared in the revolving-shaft core, The shaft which has a base from the central opening edge of this Rota to [is located between the small outer-diameter section extended through central opening of this Rota, the inner skin of this Rota, the large outer-diameter section which counters radial, this small outer-diameter section, and the large outer-diameter section, and] inner skin, and the flat surface which counters in the direction of an axis, In the spindle motor equipped with the base member which this shaft fixes said base member It has the end face of said Rota, and the flat side which counters through a gap. Between the flat side of said base member, and the end face of said Rota The thrust bearing section is constituted. Between the large outer-diameter section of said shaft, and the inner skin of said Rota While the radial bearing section which has the dynamic pressure generating slot of the configuration which makes a gas flow in the direction of an axis toward this thrust-bearing section is constituted, it is characterized by carrying out magnetic back pressure to the surfacing force generated in said thrust-bearing section in the direction which counters in said Rota.

[0022]

The annular projected part which projects in the direction of an axis is prepared in the part to which invention according to claim 5 counters in the spindle motor of claim 4 with the periphery edge in the end face of said Rota, or the periphery edge in the end face of this Rota in the flat side of said base member. It is characterized by giving the surfacing force to said Rota because this annular projected part checks a flow of the gas which flowed from said radial bearing section side and raises the atmospheric pressure of said thrust bearing circles.

[0023]

In the spindle motor of claim 4, the dynamic pressure generating slot of the configuration which makes said gas flow toward the method side of the inside of radial and the method side of outside is established in said thrust bearing section, and invention according to claim 6 is characterized by the surfacing force being given to said Rota by flow of the gas by this dynamic pressure generating slot.

[0024]

Invention according to claim 7 is characterized by being equipped with the ring-like member which regulates migration of the direction of an axis of said Rota near the point of the small outer-diameter section of said shaft in the spindle motor of claim 1 thru/or either of 6.

[0025]

In the spindle motor with which invention according to claim 8 was equipped with the cylindrical sleeve of the letter of end lock out by which the shaft rotated in one with Rota of the shape of an abbreviation cup which specifies a cavity, and this Rota, and this shaft are inserted in the interior While the opening side edge side of said sleeve counters in the base and the direction of an axis of said Rota The thrust bearing section which uses a gas as a working fluid consists of that the dynamic pressure generating slot of the configuration which makes a gas flow to the method side of the inside of radial is formed in the opening side edge side of said sleeve, or the base of said Rota. While the peripheral face of said shaft and the inner skin of said sleeve counter radial, the radial bearing section which uses a gas as a working fluid is constituted, and the operation direction of the dynamic pressure generated in said thrust bearing section is characterized by carrying out magnetic back pressure in the direction which counters in said Rota.

[0026]
Invention according to claim 9 is set to the spindle motor of claim 8. In said radial bearing section The direction slot of an axis is prepared as a dynamic pressure generating slot. Between the lock out side edge side of said sleeve, and the end face of said shaft The dynamic pressure generated in said thrust bearing section and the air chamber which has an equivalent pressure substantially are formed, and said Rota is characterized by the surfacing force being given by collaboration with said thrust bearing section and this air chamber.
[0027]
Invention according to claim 10 is set to the spindle motor of claim 8. In said radial bearing section The dynamic pressure generating slot of the configuration which makes a gas flow in the direction of an axis as a dynamic pressure generating slot is prepared. Between the lock out side edge side of said sleeve, and the end face of said shaft The dynamic pressure generated in said thrust bearing section and the air chamber which has an equivalent pressure substantially are formed, and said Rota is characterized by the surfacing force being given by collaboration with said thrust bearing section and this air chamber.
[0028]
In the spindle motor of claim 8 thru/or either of 10, said shaft consists of shank material and a bell shape outer case member attached in the peripheral face of this shank material, and invention according to claim 11 is characterized by forming the free passage hole which connects the upper limit section of said radial bearing section, and the lower limit section between this shank material and this outer case member.
[0029]
In the spindle motor with which invention according to claim 12 was equipped with the cylindrical sleeve of the letter of end lock out by which the shaft rotated in one with Rota of the shape of an abbreviation cup which specifies a cavity, and this Rota, and this shaft are inserted in the interior While the peripheral face of said shaft and the inner skin of said sleeve counter radial, the radial bearing section which uses a gas as a working fluid is constituted. In said radial bearing section The dynamic pressure generating slot of the configuration which makes a gas flow in the direction of an axis as a dynamic pressure generating slot is prepared. Between the lock out side edge side of said sleeve, and the end face of said shaft While, as for said Rota, the surfacing force is given by this air chamber by forming the air chamber by which the gas the pressure up was carried out [the gas] by flow of the direction of an axis of the gas generated in said radial bearing section is held In said Rota, it is characterized by carrying out magnetic back pressure to the surfacing force of said Rota generated in said air chamber in the direction which counters.
[0030]
In the spindle motor of claim 12, said shaft consists of shank material and a bell shape outer case member attached in the peripheral face of this shank material, and invention according to claim 13 is characterized by forming the free passage hole which connects the upper limit section of said radial bearing section, and the lower limit section between this shank material and this outer case member.
[0031]
In the spindle motor with which invention according to claim 14 was equipped with the cylindrical sleeve of the letter of end lock out by which the shaft rotated in one with Rota of the shape of an abbreviation cup which specifies a cavity, and this Rota, and this shaft are inserted in the interior While the lock out side edge side of said sleeve and the end face of said shaft counter in the direction of an axis While the thrust-bearing section in which the dynamic pressure generating slot of the configuration which makes a gas flow toward the method side of the inside of radial was established is constituted and the peripheral face of said shaft and the inner skin of said sleeve counter radial The radial bearing section in which the dynamic pressure generating slot of the configuration which makes a gas flow in said direction of the thrust-bearing section was established is constituted, and it is characterized by carrying out magnetic back pressure in the direction which counters in said Rota with the operation direction of the dynamic pressure generated in said thrust-bearing section.
[0032]
In the disk driving gear with which the rotation drive of the record disk with which invention according to claim 15 can record information is carried out Housing and the spindle motor which is fixed to the interior of this housing and made to rotate this record disk, The disk driving gear which is a disk driving gear which has an information access means for writing in or reading information to this record disk, and is characterized by coming to have the spindle motor indicated to claim 1 thru/or either of 14 as said spindle motor.
[0033]
By the way, invention indicated to claims other than claim 1 is explained in full detail in the gestalt of implementation of the following invention about the principle in the operation effectiveness list by the configuration of invention concerning each claim, in order to avoid the duplicate publication about the configuration adapted to the operation gestalt of this invention.

[0034]
[Embodiment of the Invention]
Next, the operation gestalt of the spindle motor applied to this invention with reference to each drawing and the disk driving gear using this spindle motor is explained. In addition, although the vertical direction of each drawing is made into the "vertical direction" for convenience in explanation of this operation gestalt, the direction in the actual attachment condition of a spindle motor is not limited.
[0035]
(Example 1)
First, the spindle motor applied to the 1st operation gestalt of this invention with reference to drawing 1 and drawing 2 is explained. The spindle motor illustrated by drawing 1 has the shaft 4 set up by the abbreviation center section of the bracket 2, and the rotor hub 6 supported by this shaft 4 free [rotation]. The shaft 4 consists of shank 4a of the shape of a cylinder which the direction lower limit section of an axis fixes to a bracket 2, and outer case section 4b attached in the peripheral face of this shank 4a.
[0036]
A rotor hub 6 consists of approximate circle tabular top-plate 6a in which the central opening six a1 in which the point of shank 4a is inserted was formed, and cylinder wall 6b which hangs from the periphery edge of this top-plate 6a to the direction lower part side of an axis toward a bracket 2 side. While flange-like disk installation section 6c in which record disks (it illustrates as a disk plate 53 in drawing 5), such as a hard disk, are laid is prepared in the peripheral face of cylinder wall 6b, the ring-like Rota magnet 8 is attached in the direction bottom peripheral face of an axis.
[0037]
As for outer case section 4b and the rotor hub 6 which constitute these shafts 4, it is desirable to form from metal material, such as stainless steel in which lubricative coats, such as hardening coats, such as diamond-like carbon coating, and molybdenum disulfide coating, were formed on ceramic material or front faces, such as an alumina.
[0038]
Moreover, the bracket 2 has the configuration of the shape of an abbreviation cup which carries out opening toward the direction upper limit section side of an axis of shank 4a, and it has fixed so that a stator 10 may counter the inner skin from the method of the outside of radial through an opening to the Rota magnet 8. The direction upper part of an axis of a stator 10 is covered with the magnetic-shielding plate 12 of the shape of a periphery which consists of a ferromagnetic, in order to eliminate the effect on the record disk by the magnetic leakage flux from the magnetic path formed between a stator 10 and the Rota magnet 8.
[0039]
the peripheral face of shank 4a projected from the rotor hub 6 to the direction upper part side of an axis -- the path of the central opening six a1 -- a large -- the outer diameter ring-like member 13 is attached and migration of the direction of an axis of a rotor hub 6 is regulated by this ring-like member 13. That is, ****** of a rotor hub 6 consists of that the ring-like member 13 is engaged to a rotor hub 6.
[0040]
In addition, a bracket 2 and the upper limit section of shank 4a are fixed to the case (in drawing 5 , it illustrates as housing 51) of the disk driving gear with which this spindle motor is contained. Thus, even when the thinning of the case of a disk driving gear is carried out for thin-shape-izing of equipment etc. by adopting the structure of the so-called both-ends immobilization where the direction of axis vertical edge of a spindle motor was fixed to the case of a disk driving gear, it enables the spindle motor itself to secure robustness by so to speak bearing a role of a column within a case. Moreover, since the rigidity of the fixed side member of the spindle motor containing a bracket 2 and a shaft 4 is also strengthened, the property over disturbance, such as a circumference of the deflection of a rotor hub 6, and vibration or an impact, will be improved. In addition, a bracket 2 can also be formed in the case of a disk driving gear, and one.
[0041]
Next, the configuration of bearing of the spindle motor concerning this operation gestalt is explained. There is it along the periphery of the central opening six a1, the annular projected part six a2 is formed in the inferior surface of tongue of top-plate 6a of a rotor hub 6, and this annular projected part six a2 contacts outer case section 4b of a shaft 4 at the time of a halt of a spindle motor. The gap 14 which the method side of the outside of radial formed the gap 14 between the top faces of outer case section 4b of a shaft 4, has countered it rather than the annular projected part six a2 kicked on the inferior surface of tongue of top-plate 6a of a rotor hub 6 at this time, and is formed between the inferior surface of tongue of this top-plate 6a and the top face of outer case section 4b functions as the thrust bearing section as it is explained later.
[0042]

Moreover, while the peripheral face of outer case section 4b of a shaft 4 counters with the inner skin of cylinder wall 6b of a rotor hub 6, the radial bearing section 16 which uses gases, such as air, as a working fluid consists of that dynamic pressure generating slot 16a is prepared in the front face. dynamic pressure generating slot 16a form in this radial bearing section 16 consider as a spiral configuration as it expose a part of outer case section 4b in drawing 1 and be show , and also it can be make into the herringbone configuration imbalanced in the direction of an axis where of the direction of the direction dimension of an axis of the spiral slot locate in the air flow way A side compared with the direction dimension of an axis of the spiral slot locate in a gap 14 side be set up for a long time .

[0043]

In the list between the top face of the magnetic-shielding plate 12, and the inferior surfaces of tongue of disk installation section 6c, between the inner skin of the magnetic-shielding plate 12, and the peripheral face of cylinder wall 6b The opening which follows the opening formed between the Rota magnet 8 and a stator 10 is formed. Between the inferior surface of tongue of cylinder wall 6b and the Rota magnet 8, and the top face of a bracket 2 The opening which follows the opening formed between the Rota magnet 8 and a stator 10 is formed. Of the opening of these single strings, the air flow way A which continues from the outside of a motor to the radial bearing section 16 is formed.

[0044]

If a rotor hub 6 begins rotation, in the radial bearing section 16, it pushes into the direction upper part 14, i.e., gap, side of an axis, incorporating the open air through the air flow way A according to the pumping operation by dynamic pressure generating slot 16a, and it applies to a gap 14 from the direction lower limit section of an axis of the radial bearing section 16, and high pressure liquid film with air is formed. As described above at the time of a halt of a spindle motor Since the rotor hub 6 touches the top face of outer case section 4b in the annular projected part six a2, the air sent into the direction upper part side of an axis according to a pumping operation of the radial bearing section 16 It collects in a gap 14, a rotor hub 6 surfaces to a shaft 4 in the phase where the pressure up of the inside of this gap 14 was carried out to 1 or more constant pressures, and rotation is started by non-contact. Thus, by collaborating with the radial bearing section 16, a gap 14 will have a function as the thrust bearing section.

[0045]

Since a clearance is generated between the annular projected part six a2 and the top face of outer case section 4b, the open air collected on the gap 14 will fall out, and the surfacing force of a rotor hub 6 will decline a little, because a rotor hub 2 surfaces. However, the annular thrust yoke 18 formed in the location which counters a bracket 2 in the inferior surface of tongue and the direction of an axis of the Rota magnet 8 from ferromagnetics, such as stainless steel, is arranged. With the magnetic force which acts on a rotor hub 6 between this thrust yoke 18 and the Rota magnet 8, since it will always be drawn in at a bracket 2 side The surfacing force and this magnetic force of the rotor hub 6 generated because the inside of a gap 14 carries out a pressure up balance, and the clearance between the annular projected part six a2 and outer case section 4b does not become larger than the specified quantity, and surfacing of a rotor hub 6 is stabilized.

[0046]

Thus, while a processing man day is reduced and the yield is improved by considering as the configuration in which one dynamic pressure bearing as which high process tolerance is required from a front face, a configuration, etc. was formed between the peripheral face of outer case member 4b, and the inner skin of cylinder wall 6b, it becomes possible to low-cost-ize. Moreover, an outer diameter becomes applicable also in the minimum spindle motor which drives the minor diameter disk which is 1 inch by changing to bearing and making into max area in which the radial bearing section 16 occupies the formation part of bearing also in the dimension restricted by considering as min like the above-mentioned configuration, by carrying out magnetic back pressure of the rotor hub 6, and supporting it.

[0047]

Moreover, since the gas itself is a fluid with viscosity lower than liquids, such as oil, the viscous drag at the time of rotation becomes small as much as possible conjointly with the configuration of having prepared one dynamic pressure bearing. Therefore, it is possible for loss of the rotation load generated in bearing to be reduced, and to reduce the consumed electric power of a spindle motor.

[0048]

Furthermore, a gas cannot be easily influenced of external environments, such as temperature or a pressure, compared with a liquid, that is, since it is a fluid with a very small change of a property, by supporting a rotor hub 6, using this as a working fluid, even if it is under various environments, it is possible to continue maintaining predetermined bearing rigidity, and the rotation stabilized very much can be obtained.

[0049]

In addition, the contact at the time of a halt of the spindle motor of a rotor hub 6 and a shaft 4 Since it generates only in the annular projected part six a2 and the top-face part of outer case section 4b, a rotor hub 6 descends gradually from a stationary rotation condition until a rotor hub 6 surfaces from starting of a spindle motor, and by the time it stops completely, will generate. Mechanical contact and sliding with a rotor hub 6 and a shaft 4 are suppressed to the minimum, and generating and raising dust of anomalous attrition are prevented.
[0050]
Moreover, although it is the gestalt which depended for the thrust-bearing section on the pumping operation of the radial bearing section 16 in the above-mentioned configuration On the top face of outer case section 4b which does not form the annular projected part six a2 in drawing 1 , but constitutes the thrust bearing section between the inferior surfaces of tongue of top-plate 6a The spiral slot of the configuration which feeds air like the radial bearing section to the method 16, i.e., the radial bearing section, side of the outside of radial, or the dynamic pressure generating slot by the herringbone slot imbalanced to radial is formed. It is also possible to arrange the hydrodynamic bearing which functions actively according to rotation of a spindle motor.
[0051]
Thus, although some of advantages by the configuration in drawing 1 are lost by supporting the thrust direction of a rotor hub 6 by the hydrodynamic bearing, it becomes possible to surface a rotor hub 6 with a rotational speed low in comparison according to the pumping operation by the dynamic pressure generating slot.
[0052]
(Example 2)
Next, with reference to drawing 2 , the spindle motor concerning the 2nd operation gestalt of this invention is explained. In addition, in the spindle motor illustrated by drawing 2 , about the spindle motor concerning the operation gestalt of the above 1st, and the part which has the same configuration substantially, the same drawing number is attached and the explanation is omitted.
[0053]
In the spindle motor concerning the 2nd operation gestalt of this invention, gap 14' which bears the function as the thrust-bearing section has a different configuration from the spindle motor applied to the operation gestalt of the above 1st at the point currently formed between rotor hub 6' and a bracket 2.
[0054]
That is, annular projected part 6b'1 which projects in a bracket 2 side is prepared in the periphery edge of the inferior surface of tongue of cylinder wall 6b' in rotor hub 6', and gap 14' is formed between the top faces of a bracket 2 in the field by the side of the method of the inside of radial rather than annular projected part 6b'1 in the inferior surface of tongue of cylinder wall 6b'. moreover -- a gap -- 14 -- ' -- a cylinder -- a wall -- six -- b -- ' -- an inferior surface of tongue -- a bracket -- two -- a top face -- between -- forming -- having -- things -- from -- radial bearing -- the section -- 16 -- ' -- it can set -- dynamic pressure -- generating -- a slot -- 16 -- a -- ' -- the above -- the -- one -- operation -- a gestalt -- a spiral -- a slot -- or -- a herringbone -- a slot -- an axis -- a direction -- it can set -- hard flow -- the open air -- feeding -- a configuration -- having -- ******** .
[0055]
this -- the time -- a spindle motor -- a halt -- the time -- also setting -- a shank -- four -- a -- a peripheral face -- a rotor hub -- six -- ' -- a top plate -- six -- a -- ' -- preparing -- having had -- a center -- opening -- six -- a -- one -- ' -- between -- forming -- having -- a gap -- from -- radial bearing -- the section -- 16 -- ' -- an axis -- a direction -- upper limit -- the section -- resulting -- air -- a flow -- a way -- B -- forming -- having -- as -- It is necessary to determine the amount of protrusions of annular projected part 6b'1, and to secure a clearance between the inferior surface of tongue of top-plate 6a', and the top face of outer case section 4b.
[0056]
Also in this configuration, it is possible to acquire the same advantage as the spindle motor concerning the operation gestalt of the above 1st. Moreover, it is also possible to prepare dynamic pressure bearing as the thrust-bearing section between the inferior surface of tongue of outer case section 6b' and the top face of a bracket 2.
[0057]
(Example 3)
Next, the 3rd operation gestalt of the spindle motor applied to this invention with reference to drawing 3 is explained. The spindle motor illustrated by drawing 3 has the rotor hub 26 in which the shaft 24 inserted into the space specified by the disc-like covering member 25 which seals the bell shape sleeve 23 set up in boss section 22a of the shape of a cylinder prepared in the abbreviation center section of the bracket 22 and opening by the side of the direction lower-limit section of an axis of this sleeve 23, and the inner skin of these

sleeves 23 and the top face of the covering member 25 was formed in one. The shaft 24 consists of shank 24a prolonged from the center section of the rotor hub 26, and outer case section 24b attached in the peripheral face of this shank 24a.

[0058]

Moreover, a rotor hub 26 consists of shank 4a, approximate circle tabular top-plate 26a formed in the shape of a said alignment, and cylinder wall 26b which hangs from the periphery edge of this top-plate 26a to the direction lower part side of an axis toward a bracket 22 side. While flange-like disk installation section 26c in which record disks (it illustrates as a disk plate 53 in drawing 5), such as a hard disk, are laid is prepared in the peripheral face of cylinder wall 26b, the ring-like Rota magnet 28 is attached in the direction bottom peripheral face of an axis.

[0059]

As for a sleeve 23 and the covering member 25, it is desirable to form in ceramic material or front faces, such as an alumina, from metal material, such as stainless steel which gave lubricative coats, such as hardening coats, such as diamond-like carbon coating, and molybdenum disulfide coating, in the outer case section 24b list which constitutes these shafts 24.

[0060]

Moreover, the bracket 22 has the configuration of the shape of an abbreviation cup which carries out opening toward the direction upper limit section side of an axis of a sleeve 23, and it has fixed so that a stator 30 may counter the inner skin from the method of the outside of radial through an opening to the Rota magnet 28. The direction upper part of an axis of a stator 30 is covered with the magnetic-shielding plate 32 of the shape of a periphery which consists of a ferromagnetic, in order to eliminate the effect on the record disk by the magnetic leakage flux from the magnetic path formed between a stator 30 and the Rota magnet 28.

[0061]

furthermore, annular flange 23a which projects in the method side of the outside of radial prepares in the peripheral face upper limit section of a sleeve 23 -- having -- **** -- moreover -- the inner skin of cylinder wall 26b of a rotor hub 26 -- the outer diameter of a sleeve 23 -- small -- the bore ring-like member 33 is attached and migration of the direction of an axis of a rotor hub 26 is regulated by this ring-like member 33 and flange 2. That is, ****** of a rotor hub 26 consists of that the ring-like member 33 is engaged to flange 23a.

[0062]

Next, the configuration of bearing of the spindle motor concerning this operation gestalt is explained. First, dynamic pressure generating slot 27a by the herringbone slot imbalanced to the spiral slot of the configuration which feeds air to the method side of the outside of radial, or radial is formed in the top face of a sleeve 23, and the thrust bearing section 27 which uses gases, such as air, as a working fluid between the inferior surfaces of tongue of top-plate 26a of a rotor hub 26 is constituted.

[0063]

Moreover, while the inner skin of a sleeve 23 counters with the peripheral face of outer case section 24b of a shaft 24, the radial bearing section 36 which uses gases, such as air, as a working fluid is constituted from dynamic pressure generating slot 36a which consists of a direction slot of an axis being intermittently prepared in a hoop direction by the front face.

[0064]

Furthermore, the direction dimension of an axis of the shaft 24 which consists of shank 24a and outer case section 24b is set up a little shorter than the direction dimension of an axis of the space specified by the inner skin of a sleeve 23, and the top face of the covering member 25, and, thereby, the air chamber 29 which is the space where air was held is specified between the point inferior surface of tongue of a shaft 24, and the top face of the covering member 25.

[0065]

In the list between the top face of the magnetic-shielding plate 32, and the inferior surfaces of tongue of disk installation section 26c, between the inner skin of the magnetic-shielding plate 32, and the peripheral face of cylinder wall 26b The opening which follows the opening formed between the Rota magnet 28 and a stator 30 is formed. Moreover, between the inferior surface of tongue of cylinder wall 26b and the Rota magnet 28, and the top face of a bracket 22, the air flow way C is formed of the opening of these single strings succeeding the opening formed between the Rota magnet 28 and a stator 30.

[0066]

In a **** configuration, if a spindle motor rotates, dynamic pressure will occur because the air currently held in dynamic pressure generating slot 27a of the thrust bearing section 27 flows to the method side of the inside of radial, and surfacing of a rotor hub 26 will be started. Moreover, also in the radial bearing section 36, the dynamic pressure by dynamic pressure generating slot 36a occurs, and it aligns a rotor hub 26.

[0067]
The thrust bearing section 27 follows the air flow way C because a rotor hub 26 surfaces, and the open air is incorporated in bearing in the pumping operation by dynamic pressure generating slot 27a.
[0068]
Thus, if the open air is incorporated according to a pumping operation of the thrust bearing section 27, the pressure up of the air held in the air chamber specified by the point inferior surface of tongue of a shaft 24 and the top face of the covering member 25 will be carried out. That is, in the spindle motor concerning this operation gestalt, it has the composition of acquiring the surfacing force of a rotor hub 26 because the thrust-bearing section 27 and an air chamber 29 collaborate.
[0069]
It also sets in this operation gestalt like the case of the operation gestalt of the above 1st. Moreover, in a rotor hub 26 With the magnetic force which acts between a thrust yoke 38 and the Rota magnet 28 It is always drawn in at the bracket 2 side, the surfacing force and this magnetic force of the rotor hub 26 generated because the inside of the space formed between the point inferior surface of tongue of a shaft 24 and the top face of the covering member 25 carries out a pressure up balance, and surfacing of a rotor hub 6 is stabilized.
[0070]
Also in this configuration, it is possible to acquire the same advantage as the spindle motor concerning the above 1st and the 2nd operation gestalt.
[0071]
In addition, since it is the configuration which feeds air toward an air chamber 29 side in the above-mentioned configuration by the thrust bearing section 27 and it is not necessary to make air flow in the direction of an axis in the radial bearing section 36 Although considered as the configuration of the so-called step type which formed the direction slot of an axis as dynamic pressure generating slot 36a of hydrodynamic bearing It changes to this. As the spiral slot or herringbone slot of the configuration which feeds air to the direction hard flow of an axis with the spiral slot or herringbone slot illustrated by drawing 1 in dynamic pressure generating slot 36a prepared in the radial bearing section 36 It is also possible to consider as the configuration which feeds air to an air chamber 29 side according to a pumping operation of the radial bearing section 36, and to consider as the configuration which does not form the thrust bearing section 27.
[0072]
Thus, when feeding air by the radial bearing section 36, it is required to make the radial bearing section 36 follow the air flow way C at the time of a halt of a spindle motor. Therefore, it is necessary to make it larger than the direction dimension of an axis of the space to which the direction dimension of an axis of a shaft 24 is specified by the sleeve 23 and the covering member 25. In this case, in order to ensure surfacing of a rotor hub 26, the small projection is prepared in the axial center section under [of shank 24a] a point, and it is desirable in this point contact or to carry out field contact and to secure an air chamber 29 in the top face of the covering member 25.
[0073]
(Example 4)
Next, with reference to drawing 4 , the spindle motor concerning the 4th operation gestalt of this invention is explained. This drawing 4 is a sectional view shown where the front face of shank 24a' which constitutes shaft 24' is exposed. In addition, in the spindle motor illustrated by drawing 4 , about the spindle motor concerning the operation gestalt of the above 3rd, and the part which has the same configuration substantially, the same drawing number is attached and the explanation is omitted.
[0074]
In the spindle motor concerning the 4th operation gestalt of this invention, it has a different configuration from the spindle motor which requires for the operation gestalt of the above 3rd the free passage hole 40 which opens a direction upper limit section [of the radial bearing section 36] of axis, and lower limit section side for free passage at the point currently formed between the peripheral face of shank 24a', and outer case section 24b'.
[0075]
That is, a streak of spiral slot 40a which follows a lower limit section side is formed in the peripheral face of shank 24a' which constitutes shaft 24' from the upper limit section side, and the spiral slot 40 will be formed between spiral slot 40a and the inner skin of outer case section 254b' by outer case section 24b' being attached in the peripheral face of shank 24a'. In addition, in drawing 4 , the broken line shows spiral slot 40a about the part formed in the illustration direction rear-face side of shank 24a.
[0076]
Corresponding to the upper limit section and the lower limit section of spiral slot 40a, periphery-like 1 [crevice

24b'] which reaches the upper limit side and a lower limit side, and 24b'2 are prepared in the inner skin vertical edge of outer case section 24b' so that very few clearances may be formed between the peripheral faces of shank 24a'. The free passage hole 40 is following the radial bearing section 36 through few clearances formed between this crevice 24b'1, 24b'2, and the peripheral face of shank 24a'.

[0077]

Next, the function of this free passage hole 40 is explained.

[0078]

For example, when change arises [the gap formed between the inner skin of a sleeve 23, and the peripheral face of outer case section 24b by putting the greatest processing tolerance of the inner skin of a sleeve 23, or the peripheral face of outer case section 24b together] in a clearance dimension in a direction upper limit section of axis, and lower limit section side, induction of the unusual flow will be carried out to air. Consequently, the differential pressure of air will arise between the direction upper limit section side of an axis of the gap formed between the inner skin of a sleeve 23, and the peripheral face of outer case section 24b, and the lower limit section side 29, i.e., the thrust bearing section 27 and an air chamber. If this differential pressure is left, when the pressure up of the air in an air chamber 29 cannot be carried out, and the flying height of a rotor hub 26 will run short, when air flows from the direction lower limit section side of an axis to an upper limit section side and air will flow from the direction upper limit section side of an axis to a lower limit section side, the pressure up of the inside of an air chamber 29 is carried out beyond the need, and fault surfacing of a rotor hub 2 occurs.

[0079]

On the other hand, even if the differential pressure of air arises in a direction upper limit section [of the gap which induction of the flow of the direction of an axis is carried out to the above-mentioned air and formed by forming the free passage hole 40 between the inner skin of a sleeve 23 and the peripheral face of outer case section 24b] of axis, and lower limit section side Since an air flow to a low side arises from a side with high internal pressure through the free passage hole 40, it becomes possible to make the pressure of bearing circles balance.

[0080]

thus, since the tolerance to a processing error is markedly alike and is expanded by forming the free passage hole 40 in addition to the advantage by the configuration of the spindle motor of each above-mentioned operation gestalt, the yield is improved. Moreover, since a flow of the direction of an axis of the air in the radial bearing section is permitted, the high degree of freedom of a design can also be taken.

[0081]

moreover, the periphery-like crevice 24 in which both-ends opening of the free passage hole 40 was prepared by the inner skin of outer case section 24b', respectively so that it might be illustrated by drawing 4 -- b'1 and 24b -- flow resistance of air arises and air does not flow the inside of the free passage hole 40 rapidly because you make it located in few clearances formed between the peripheral faces of '2 and shank 24a' That is, the free passage hole 40 will have not only the adjustment function of the above-mentioned pressure but the buffer function which controls rapid pressure fluctuation.

[0082]

That is, if a rotor hub 26 sways according to disturbance, such as vibration and an impact, the gap formed in bearing circles tends to be large at the migration direction side of a rotor hub 26, and tends to become narrow in the opposite side. Since air is enabled to flow easily toward that opposite side from the side to which a gap tends to become narrow when the free passage hole 40 is directly opened for free passage by the direction of axis vertical edge of the radial bearing section 36 at this time, a pressure is changed rapidly and the deflection of a rotor hub 26 cannot be suppressed. However, while a flow of air is barred and the deflection of a rotor hub 26 is also suppressed to the minimum by enlarging circulation resistance of the double door regio oralis of the free passage hole 40, it becomes possible to return to the predetermined flying height, without requiring time amount.

[0083]

(Configuration of a disk driving gear)

The internal configuration of the common disk driving gear 50 to drawing 5 is shown as a mimetic diagram. The interior of housing 51 forms clean space with little dust, dust, etc. to the degree of pole, and the spindle motor 52 with which it was equipped with the disc-like disk plate 53 which memorizes information is installed in the interior. In addition, inside housing 51, the head migration device 57 in which information is written to the disk plate 53 is arranged, and this head migration device 57 is constituted by the actuator section 54 which moves the head 56 which write the information on the disk plate 53, the arm 55 supporting this head, a head 56, and an arm 55 to the necessary location on the disk plate 53.

[0084]
By using the spindle motor of the above-mentioned operation gestalt as a spindle motor 52 of such a disk driving gear 50, while application to small devices, such as a Personal Digital Assistant, is possible, improvement in dependability is attained at the use list of long duration.
[0085]
As mentioned above, although 1 operation gestalt of a disk driving gear was explained to the hydrodynamic bearing and spindle motor list according to this invention, various deformation thru/or corrections is possible for this invention, without not being limited to the starting operation gestalt and deviating from the range of this invention.
[0086]
For example, in the above-mentioned operation gestalt, although the shaft consists of dual structure which attached the outer case section in the peripheral face of a shank, if an erector is upper-permitted, a shaft may be integral construction.
[0087]
[Effect of the Invention]
While it is possible to attain small, thin-shape-izing, and low cost-ization according to the spindle motor of this invention, it becomes the rotation stabilized even if it was under various environments is possible, and possible to low-power-ize.
[0088]
Moreover, according to the disk driving gear of this invention, while application to small devices, such as a Personal Digital Assistant, is possible, improvement in dependability is attained at the use list of long duration.
[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the outline configuration of the spindle motor concerning the 1st operation gestalt of this invention.
[Drawing 2] It is the sectional view showing the outline configuration of the spindle motor concerning the 2nd operation gestalt of this invention.
[Drawing 3] It is the sectional view showing the outline configuration of the spindle motor concerning the 3rd operation gestalt of this invention.
[Drawing 4] It is the sectional view showing the outline configuration of the spindle motor concerning the 4th operation gestalt of this invention.
[Drawing 5] It is the sectional view showing the internal configuration of a disk driving gear typically.
[Description of Notations]
6 6' Rota
4 Shaft
4a Shank (small outer-diameter section)
4b Outer case section (large outer-diameter section)
14 14' Gap (thrust bearing section)
16 Radial Bearing Section

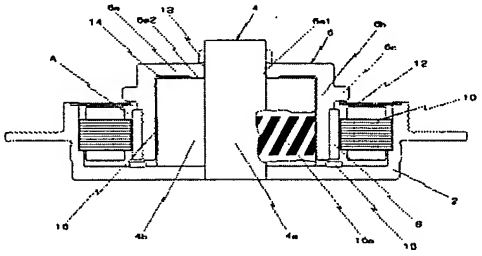
[Translation done.]

* NOTICES *

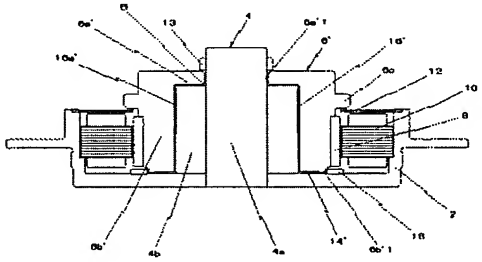
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

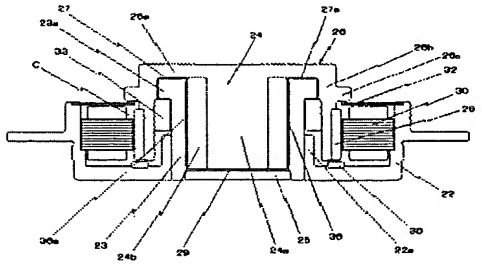
[Drawing 1]



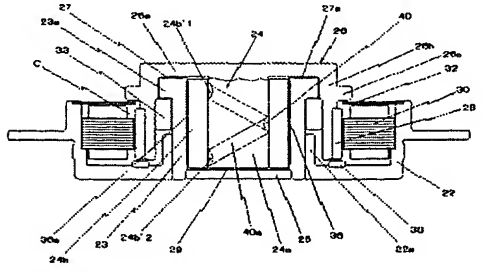
[Drawing 2]



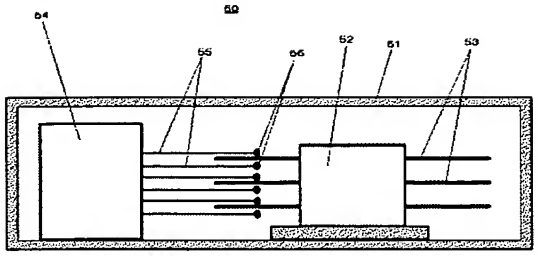
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]